AMETEK

RIEHLE®
TESTING MACHINES

A DIVISION OF AMETEK, INC.

EAST MOLINE, ILLINOIS

Installation, Operation and Maintenance Manual

TYPE Model "CT" KENTRALL HARDNESS TESTER

CAPACITY _____

SERIAL No. _____

CT-3 #211

O P E R A T I N G
I N S T R U C T I O N S
F O R
M O D E L "CT" K E N T R A L L
H A R D N E S S T E S T E R

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INSTRUCTIONS
FOR
MODEL "CT" KENTRALL HARDNESS TESTER

UNPACKING THE "KENTRALL"

Remove tester from shipping carton and place on sturdy bench. Put aluminum feet under leveling screws and front toe of tester.

TRANSPORTING: The tester should only be carried by grasping the base casting. Do not attempt to lift the instrument by any of the components that are attached to any of the castings. This is a delicate instrument and should be handled accordingly.

Remove cover from dial gauge and release elastic band on dial lever.

Remove cowl cover and press out shipping chock from rear end of power lever.

Remove back cover plate and release elastic band from upper weight rod and minor load.

Remove shipping chock for elevating screw and raise protective sleeve to top position and secure with clamp screw at rear.

SETTING UP THE "KENTRALL"

Screw out knurled needle valve screw. Lift up and fill dash pot with oil supplied. (This is a light weight oil.) Replace needle valve, turn tight and then back off 1/2 turn.

Screw on load release handle to the release ring on the front of the machine; trip the thumb lock on the front of the machine to check movement of dash pot.

Unscrew indicating knobs from each side of the machine.

Leave dash pot platform in lower position; place on weight load of 150 kilo. (These weights are numbered 1-6 from bottom up.) Be sure lower rod and weight pan assembly is in the weight stack. Set weights on weight platform pins. Pull load return handle forward to lock position. Weights should now be aligned to their respective hole positions on the side of the machine (it should show slightly low in the pin holes) so when pins are engaged they raise weight slightly to show a gap between weights for clearance.

Screw on lower rod of pan to upper rod; use a pin or spanner wrench to tighten the assembly to prevent excessive gap clearance.

Replace cowl cover and gauge cover.

To level the "KENTRALL", use the 2-1/2" diameter flat anvil -- Place a spirit level on it for positioning. The weights in machine should then plumb themselves exactly over the dashpot platform and not rub the sides of the machine.

To set dash pot speed -- Screw in needle valve on dash pot until operating handle completes its rotation and comes to rest in four to five seconds.

Replace rear cover.

ROCKWELL HARDNESS SCALES

SCALE	PENETRATOR	LOAD IN KILOGRAMS	SPECIAL MINOR LOAD WEIGHT	GAGE INDICATOR PIN POSITION	GAGE SET
(Regular)					
A	Diamond	60	Yes	"R"	Green
B	1/16" Ball	100	Yes	"R"	Red
C	Diamond	150	Yes	"R"	Green
D	Diamond	100	Yes	"R"	Green
E	1/8" Ball	100	Yes	"R"	Red
F	1/16" Ball	60	Yes	"R"	Red
G	1/16" Ball	150	Yes	"R"	Red
H	1/8" Ball	60	Yes	"R"	Red
K	1/8" Ball	150	Yes	"R"	Red
L	1/4" Ball	60	Yes	"R"	Red
M	1/4" Ball	100	Yes	"R"	Red
P	1/4" Ball	150	Yes	"R"	Red
R	1/2" Ball	60	Yes	"R"	Red
S	1/2" Ball	100	Yes	"R"	Red
V	1/2" Ball	150	Yes	"R"	Red
(Superficial)					
15N	Diamond	15	No	"S"	Green
30N	Diamond	30	No	"S"	Green
45N	Diamond	45	No	"S"	Green
15T	1/16" Ball	15	No	"S"	Green
30T	1/16" Ball	30	No	"S"	Green
45T	1/16" Ball	45	No	"S"	Green
15W	1/8" Ball	15	No	"S"	Green
30W	1/8" Ball	30	No	"S"	Green
45W	1/8" Ball	45	No	"S"	Green
15X	1/4" Ball	15	No	"S"	Green
30X	1/4" Ball	30	No	"S"	Green
45X	1/4" Ball	45	No	"S"	Green
15Y	1/2" Ball	15	No	"S"	Green
30Y	1/2" Ball	30	No	"S"	Green
45Y	1/2" Ball	45	No	"S"	Green

REGULAR SCALES:

SCALE	PENETRATOR	LOAD IN KILOGRAMS	APPLICATION OF SCALE
A	Diamond	60 Kilo	For extremely hard materials which might chip the diamond at high loads such as sintered carbides. For hard sheets which are too thin for heavier loads.
B	1/16" Ball	100 Kilo	Soft material of B0 to B100 hardness.
C	Diamond	150 Kilo	Hard Material of C20 to C70 hardness.
D	Diamond	100 Kilo	Case Hardened material
F	1/16" Ball	60 Kilo	Soft, Bearing Materials
G	1/16" Ball	150 Kilo	Phosphor Bronze

SUPERFICIAL SCALES:

15N	Diamond (Marked "X")	15 Kilo	Where "C" scale would be used if sufficiently thick
30N	Diamond (Marked "X")	30 Kilo	Where "C" scale would be used if sufficiently thick.
45N	Diamond (Marked "X")	45 Kilo	Where "C" scale would be used if sufficiently thick
15T	1/16" Ball	15 Kilo	Where "B" scale would be used if sufficinetly thick
30T	1/16" Ball	30 Kilo	Where "B" scale would be used if sufficiently thick
45T	1/16" Ball	45 Kilo	Where "B" scale would be used if sufficiently thick

PENETRATORS: It should be noted above that the Diamond Penetrator is intended for use with hard materials only. When testing materials where the hardness is higher than B-100 or the "T" or "N" scale equivalent to B-100, one should always use the Diamond Penetrator. For hardness values of B-100 to B-0, the 1/16" Ball should be used. The above table lists the various scales which are recommended for the various types of specimens. The KENDENT X Diamond Cone Indenter is specially selected to satisfy the exacting requirements of both "C" and "N" scale testing. Here again one instrument takes the place of two or even three. "A", "C", or "N" scale indenters are available for limited applications. All indenters are very carefully calibrated in our laboratory and graded according to the most rigid specifications.

WEIGHTS-MAJOR LOAD: It is not necessary to add or to remove individual Major Load weights manually when changing this instrument from one hardness scale to another. Once the Major Load Weight Assembly is placed in the machine when set up initially, the weights are permanently attached. The Major Load weight Assembly is comprised of six individual weights. These six may be engaged independently or in combination to obtain a Major Load from 15 kilograms to 150 kilograms as may be required. The selection of the proper Major Load may be accomplished by engaging the Weight Knobs in the correct holes. Any extra weight on the Major Load Assembly will be disengaged automatically from the assembly and locked in a disengaged position. The weight Knobs should be screwed into the appropriate holes, for the desired Major Load as indicated on the engraved plates adjoining the holes. The full 150 kilograms Major Load is accomplished by retracting the Weight Knobs.

The left weight Knob (the one with three prongs) should be screwed in first until engaged and finger tight. The right knob should then be similarly engaged. This sequence of first engaging the left and then the right knob will insure the proper alignment of the Major Load Weight Assembly within the instrument. When engaging or disengaging weights, the weight platform assembly must be locked in position to assure alignment.

WEIGHTS-MINOR LOAD: There is a difference in the Minor Loads required for Regular and Superficial Rockwell Hardness Testing. The Regular test has a 10 kilogram minor load while the Superficial test has a 3 kilogram minor load.

The weight pan of this instrument has been so designed that, by its own weight it automatically adds the required load for a Superficial test, ie, 3 kgs. When Regular tests are to be taken, it is necessary to add the special weight to the top of the connector of the Weight Pan Assembly. The addition of this extra weight increases the total weight of the weight Pan to the 10 kilograms required for the Minor Load in the Regular test. Under this arrangement the weight Pan is always suspended on the beam assembly and the Minor Load is applied automatically as the instrument is operated. Then through the functioning of the dash pot, the appropriate additional weights are lowered on to the system and the proper major load is applied to the specimen.

To add the 7 kg. Minor Load Addition for Regular testing, place a test block or test specimen on the anvil and turn up the elevating unit until firm resistance is met which will indicate the gap between the minor load weight pan and the major load has been closed. Now unscrew the two weight knobs releasing the Minor Load Addition.

To remove the 7 kg. Minor Load Addition for Superficial testing, turn up the elevating unit with a test block in place as before until firm resistance is met and then screw in the upper Weight Knobs, securing the Addition.

ANVILS: Four anvils have been supplied with this instrument:

"V" Type Anvil - This anvil should be used for wire and small diameter parts from 1/16" to 1/4". The cylindrical face of the round piece should never be supported on a flat anvil.

Small Round Anvil - This anvil is for testing round work from 1/4" to 4" in diameter.

2-1/2" Diameter Flat Anvil - This anvil should be used for testing flat bottomed pieces of heavy section.

"SPOT" Type Anvil - This anvil should be used for small pieces, thin pieces and for specimens with a bottom which may not be absolutely flat. A specimen must have a positive contact with the anvil at a point directly beneath the penetrator. Use this anvil to check tester with test block.

PRELIMINARY ADJUSTMENTS

SELECTION OF SCALES: The dial indicator or gauge has only one series of numbers but any scale being used may be read directly on it. Since greater sensitivity is required in the case of tests in the Superficial ranges, a simple adjustment has been provided in the linkage between the beam assembly and the Dial Indicator to maintain the proper ratio for either Regular or Superficial readings. This ratio adjustment is accomplished easily by inserting the Gauge Indicator Pin into the hole indicated as "S" (For Superficial) or "R" (For Regular).

It may be necessary to lift upward somewhat to obtain the hole alignment when inserting the Gauge Indicator Pin. Once the pin is inserted in the correct hole, it should be rotated to be certain it is free and not binding.

DIAL INDICATOR ADJUSTMENTS: While the 100 dial divisions are sufficient for "C" scale and for Superficial scales, to avoid negative values when using the "B" scale, 130 dial divisions are required. Accordingly, when the "B" scale is to be used, the dial face must be shifted clockwise with the Dial Setting Finger Control until the red arrow is at the 12 o'clock position. This arrow must be used as the "SET" or starting position when conducting "B", "F", or "G" tests or other Regular scales, using a ball penetrator. For Regular scales using a diamond indenter and for all Superficial scales, use the "0" point or green arrow on the dial as the "Set Point".

ADJUSTMENT OF MINOR AND MAJOR LOAD CLEARANCE: To determine if adequate clearance exists between the minor and major load, put a piece of steel or brass on the anvil and elevate the sample against the penetrator. Continue turning the elevating nut until the small pointer on the face of the dial is almost vertical and the large pointer is at zero. Once more continue elevating the sample until the Major Load is encountered. At this point the large pointer should indicate at least "30" on the dial to one-half a complete revolution, of the pointer beyond the zero point. If less than "30", it is necessary to reset the clearance; to do so it is necessary to remove the Dial Cover Casting by loosening the Knurled Knob at the top front surface and by pulling the casting forward. Once the Dial Cover Casting has been removed, the Top Casting may be removed by removing the two screws and by carefully lifting the casting upward. Then loosen the knob at the rear of the eccentric that locks the eccentric. After rotating the eccentric as required, the knob at the rear of the eccentric should be tightened at theproper point to allow a clearance of 30 divisions. The rotation of the eccentric adjusts the dial gauge and consequently the clearance between the Major and Minor Loads.

When the required 30 dial divisions clearance is obtained, the Top Casting should be replaced and then the cover casting should be attached to it and the knurled knob at the top front retightened.

OPERATING INSTRUCTIONS

PRELIMINARY STEPS:

1. Check the Weight Knobs to be certain that the appropriate Major Load Weights have been added for the particular scale desired, e.g., 150 kg. 100, etc.

2. Check to see that Minor Load Weight has been added to or removed from the Weight Platform depending upon whether Regular or Superficial tests are being made.

3. Check to see that the Gauge Indicator Pin is in Hole "R" if Regular tests are to be taken or in Hole "S" if Superficial tests are to be taken. Rotate the pin to be certain it is free and not binding.

4. Insert the correct penetrator in the penetrator holder - the selection should be made according to the recommendations made earlier in "Penetrators and Loads".

   The penetrator should be inserted in the opening in the Penetrator Holder directly above the anvil. In inserting or removing the penetrator be careful to avoid striking the anvil with the penetrator tip since this may chip the diamond. After inserting a penetrator rotate it to be sure it is seated properly.

5. Select the correct anvil and place it on the elevating screw. In removing or in replacing an anvil it should be held so that one finger is between the anvil top and the undersurface of the Penetrator Holder. If the anvil is permitted to strike the holder, it may cause a burr on the holder and improper seating of the penetrator will result.

6. Examine the specimen to be tested to be certain the undersurface which will rest on the anvil is free of burr or scale. Such imperfections will flatten under the test load and result in incorrect reading.

TEST CYCLE:

1. Place specimen to be tested on the anvil.

2. Engage Minor Load by turning the Elevating Nut Handle (Uppermost handle) in a clockwise direction and thus elevating the specimen into contact with the penetrator. Once the specimen has contacted the penetrator continue to turn the Elevating Handle in a clockwise direction until the small pointer on the dial gauge is almost vertical. Then, carefully continue turning until the large pointer rests on the 'Start' area.

3. Turn Knurled Zero Adjuster on the elevating assembly clockwise or counter-clockwise as required until the green arrow (in the case of Regular "C" or Superficial readings) or the red arrow (in the case of Regular "B" readings) is exactly behind the big pointer: Refer to table describing scale selections to determine if red or green gauge set point should be used.

4. Trip or depress Thumb Lock on the front of the tester so that the Stop disengages and major load may be applied.

5. When pointer comes to a rest, pull lowest handle slowly clockwise until thumb lock engages stop and locks major weights in a disengaged position DO NOT JERK OR SNAP THE HANDLE FORWARD.

6. Read the Rockwell Hardness Number on the dial.

7. Turn the Elevating Handwheel in a counter-clockwise direction to lower anvil and relocate specimen for the next test.

"KENTRALL" SERVICING

Low Readings: The following causes for low readings have been isolated for the "KENTRALL" Hardness Tester. Corrective action is indicated.

1. Dirt or nicks on the shoulder of the penetrator or penetrator holder -- clean or remove nicks.

2. Dirt or nicks on the shoulder of anvil or tight fit of shank due to nicks or nicks on mating surface of the anvil bushing in the elevating screw Clean or remove nicks.

3. Improper anvil allowing movement of part -- select recommended anvil for shape of part being tested.

4. Poor undersurface allowing movement of part against anvil -- prepare undersurface to fit tightly against anvil.

5. Poor test surface -- this is unpredictable. Readings may be either high or low depending on the character of the surface.

6. Too much oil between elevating nut and elevating screw bushing -- clean and replace with one or two drops of elevating unit oil.

7. Loose penetrator holder -- tighten using an adjustable end wrench.

8. Tester operating too fast -- slow speed by tightening dash pot needle valve (turn clockwise to slow down)

9. Lower half of weight pan loose -- tighten pan using a pin in the holes at the bottom of the pan.

10. Damaged diamond indenter -- check tester with ball penetrator and/or with replacement diamond indenter.

11. Dirt inside penetrator holder affecting ball and lifting rod sets -- using an end wrench, remove penetrator holder. Clean balls and also seats in penetrator holder and lifting rod. Oil lightly and replace being sure rod is exactly vertical so it feeds up into the seat in the adjusting screw on the beam.

12. Damaged dial gauge -- the only way to be certain of this is to try a replacement gauge. A sticky gauge, which can be detected by working the racks in and out with the gauge face held horizontal, generally results in high readings.

RIEHLE® TESTING MACHINES
A DIVISION OF AMETEK, INC.
EAST MOLINE, ILLINOIS

COMPARATIVE HARDNESS VALUES*

"ONE TEST IS WORTH A THOUSAND EXPERT OPINIONS"®

ROCKWELL							Diamond Pyramid	Brinell	Knoop	Tensile Strength
C	A	D	15N	30N	45N	G	1/16" Ball Penetrator	136° Diamond Pyramid Indenter	10 MM Standard Steel Ball	Knoop Indenter	Thousand lbs. per sq. in.
KENDENT Diamond Cone Indenter											
150 KG	60 KG	100 KG	15 KG	30 KG	45 KG	150 KG	5-50 KG	3000 KG	500 GMS		
70	86.5	78.5	94.0	86.0	77.5		1075		1029		
69	86.0	77.7	93.6	85.1	76.5		1007		988		
68	85.4	77.0	93.3	84.3	75.4		940		949		
67	85.0	76.2	92.9	83.5	74.3		900		912		
66	84.6	75.5	92.5	82.7	73.2		865		877		
65	84.1	74.7	92.1	81.8	72.1		832		844		
64	83.5	73.9	91.8	80.9	71.0		800		814		
63	82.9	73.1	91.5	80.0	69.9		772		787		
62	82.3	72.3	91.1	79.1	68.8		746		762		
61	81.7	71.5	90.7	78.2	67.7		720		738		
60	81.2	70.8	90.3	77.3	66.6		697		715		
59	80.6	70.0	89.9	76.4	65.5		674		693		
58	80.1	69.3	89.4	75.5	64.3		653		671		
57	79.6	68.5	89.0	74.6	63.1		633		650		
56	79.0	67.7	88.5	73.8	62.0		613		630		
55	78.5	67.0	88.0	72.9	60.8		595		611	301	
54	78.0	66.2	87.5	72.0	59.6		577		593	292	
53	77.5	65.5	87.0	71.1	58.4		560		575	283	
52	77.0	64.7	86.5	70.2	57.2		544	500	558	272	
51	76.4	63.9	86.0	69.3	56.0		528	487	542	264	
50	75.9	63.1	85.5	68.4	54.9		513	475	527	256	
49	75.3	62.3	85.0	67.5	53.7		498	464	513	246	
48	74.8	61.5	84.5	66.6	52.5		484	451	500	237	
47	74.3	60.8	84.0	65.7	51.4		471	442	487	229	
46	73.7	60.0	83.5	64.8	50.2		458	432	475	221	
45	73.2	59.3	83.0	63.9	49.0		446	421	463	215	
44	72.7	58.5	82.4	63.0	47.8		434	409	451	208	
43	72.1	57.7	81.9	62.1	46.7		423	400	440	201	
42	71.6	56.9	81.4	61.2	45.5		412	390	429	194	
41	71.0	56.2	80.9	60.3	44.3		402	381	419	188	
40	70.5	55.4	80.4	59.5	43.1		392	371	409	182	
39	70.0	54.6	79.8	58.6	41.9		382	362	400	177	
38	69.5	53.8	79.3	57.7	40.7		372	353	391	171	
37	69.0	53.1	78.8	56.8	39.6		363	344	383	166	
36	68.5	52.3	78.3	55.9	38.4		354	336	375	162	
35	68.0	51.5	77.7	55.0	37.2		345	327	367	157	
34	67.5	50.8	77.1	54.1	36.0		336	319	359	153	
33	67.0	50.0	76.6	53.1	34.9		327	311	351	149	
32	66.5	49.3	76.0	52.2	33.7		318	301	343	145	
31	66.0	48.5	75.5	51.3	32.5		310	294	335	142	
30	65.5	47.7	75.0	50.4	31.4	92.0	302	286	328	139	
29	65.0	47.0	74.4	49.5	30.2	91.0	294	279	322	135	
28	64.5	46.3	73.9	48.6	29.0	90.0	286	271	316	132	
27	64.0	45.5	73.3	47.7	27.8	89.0	279	264	310	129	
26	63.5	44.7	72.7	46.8	26.6	88.0	272	258	305	126	
25	63.0	43.9	72.1	45.9	25.5	86.9	266	253	300	124	
24	62.5	43.2	71.6	45.0	24.3	85.8	260	247	295	121	
23	62.0	42.5	71.1	44.1	23.1	84.6	254	243	291	119	
22	61.5	41.7	70.5	43.2	21.9	83.4	248	237	287	116	
21	61.0	40.9	70.0	42.3	20.7	82.2	243	231	283	114	
20	60.5	40.1	69.5	41.4	19.6	81.0	238	226	280	112	

ROCKWELL									Diamond Pyramid	Brinell	Knoop
B	F	G	15T	30T	45T	E	K				
1/16" Ball Penetrator						1/8" Ball Penetrator			136° Diamond Pyramid Indenter	10 MM Standard Steel Ball	Knoop Indenter
100 KG	60 KG	150 KG	15 KG	30 KG	45 KG	100 KG	150 KG		5-50 KG	3000 KG	500 GMS
100		82.5	93.0	82.0	72.0		–		234	240	280
99		80.9	92.6	81.4	71.0		–		228	234	261
98		79.2	92.3	80.8	70.1		–		222	228	246
97		77.5	92.0	80.2	69.1		–		216	222	234
96		75.9	91.7	79.6	68.2		–		210	216	224
95		74.2	91.4	79.0	67.2		–		204	210	216
94		72.5	91.1	78.4	66.3		–		198	205	209
93		70.8	90.8	77.8	65.3		–		192	201	203
92		69.2	90.5	77.3	64.4		100		188	196	197
91		67.5	90.2	76.7	63.5		99.2		184	190	191
90		65.8	89.9	76.1	62.5		98.4		180	186	186
89		64.2	89.6	75.5	61.5		97.6		178	182	181
88		62.5	89.3	74.9	60.5		96.8		174	178	177
87		60.8	89.0	74.3	59.6		96.0		170	174	173
86		59.1	88.6	73.7	58.7		95.1		168	170	169
85		57.4	88.3	73.1	57.8		94.3		164	166	165
84		55.7	87.9	72.5	56.8		93.5		162	163	162
83		54.0	87.6	71.9	55.9		92.7		158	160	159
82		52.3	87.3	71.3	55.0		91.9		156	157	156
81		50.6	87.0	70.7	54.0		91.1		153	153	153
80		49.0	86.6	70.0	53.0		90.3		150	150	150
79		47.4	86.3	69.4	52.1		89.4		148	148	147
78		45.7	86.0	68.8	51.2		88.5		146	145	144
77		44.1	85.6	68.1	50.2		87.6		142	143	141
76	100	42.5	85.3	67.5	49.3		86.7		140	140	138
75	99.5	40.8	85.0	66.8	48.4		85.8		138	138	136
74	99.0	39.2	84.6	66.2	47.5		85.0		135	136	134
73	98.5	37.5	84.3	65.5	46.5		84.1		132	133	132
72	98.0	35.9	84.0	64.8	45.5		83.3		130	131	129
71	97.4	34.3	83.7	64.1	44.5	100	82.5		128	128	127
70	96.8	32.7	83.4	63.4	43.5	99.4	81.6		126	126	125
69	96.2	31.1	83.0	62.7	42.5	98.8	80.8		124	124	122
68	95.6	29.6	82.7	62.1	41.5	98.2	80.0		122	122	120
67	95.0	28.0	82.4	61.4	40.5	97.6	79.1		120	120	118
66	94.5	26.5	82.1	60.7	39.5	97.0	78.2		118	118	116
65	93.9	25.0	81.8	60.0	38.5	96.3	77.3		116	116	114
64	93.4	23.5	81.5	59.3	37.4	95.7	76.5		114	114	112
63	92.8	22.0	81.1	58.6	36.4	95.1	75.6		112	112	110
62	92.3	20.5	80.8	57.9	35.4	94.5	74.8		110	110	108
61	91.7	19.0	80.5	57.2	34.4	93.9	74.0		108	108	107
60	91.1	17.5	80.1	56.5	33.4	93.3	73.1		107	107	105
59	90.6	16.0	79.8	55.8	32.4	92.7	72.2		105	106	104
58	90.0	14.5	79.5	55.2	31.3	92.1	71.4		104	104	102
57	89.4	13.0	79.2	54.5	30.3	91.5	70.5		102	103	101
56	88.9	11.5	78.8	53.8	29.3	90.9	69.6		100	101	99
55	88.4	10.0	78.5	53.1	28.2	90.3	68.8		99	100	98
54	87.8	8.5	78.2	52.4	27.2	89.7	67.9		98	99	97
53	87.2	7.0	77.9	51.7	26.1	89.1	67.0		96	97	96
52	86.6	5.5	77.5	51.0	25.1	88.5	66.2		95	96	94
51	86.0	4.0	77.2	50.3	24.1	87.9	65.3		94	95	93
50	85.4	2.5	76.9	49.7	23.1	87.3	64.4		93	94	92

ROCKWELL										Diamond Pyramid	Brinell	Knoop
B	F	15T	30T	45T	E	H	K					
1/16" Ball Penetrator					1/8" Ball Penetrator							
100 KG	60 KG	15 KG	30 KG	45 KG	100 KG	60 KG	150 KG			136° Diamond Pyramid Indenter	10 MM Standard Steel Ball	Knoop Indenter
										5-50 KG	500 KG	500 GMS
50	85.4	76.9	49.7	23.1	87.3		64.4			93	83.0	92
49	84.9	76.5	49.0	22.0	86.7		63.5			92	82.3	91
48	84.3	76.2	48.3	20.9	86.0		62.6			90	81.5	90
47	83.8	75.9	47.7	19.9	85.4		61.8			89	80.7	89
46	83.2	75.5	47.0	18.9	84.8		60.9			88	80.0	88
45	82.6	75.2	46.3	17.8	84.2		60.0			87	79.2	87
44	82.1	74.9	45.6	16.8	83.6		59.1			86	78.4	86
43	81.5	74.6	44.9	15.7	82.9		58.3			85	77.7	85
42	81.0	74.3	44.2	14.7	82.3		57.4			84	76.8	
41	80.4	74.0	43.5	13.6	81.7		56.5			83	76.0	84
40	79.8	73.7	42.9	12.5	81.0		55.6			82	75.2	83
39	79.2	73.4	42.2	11.5	80.4		54.8			81	74.5	
38	78.6	73.0	41.5	10.5	79.8		53.9				73.7	82
37	78.1	72.7	40.8	9.5	79.2		53.0			80	72.9	
36	77.5	72.4	40.2	8.4	78.6	100	52.2			79	72.0	81
35	76.9	72.1	39.5	7.4	78.0	99.7	51.3			78	71.1	
34	76.3	71.7	38.8	6.3	77.4	99.3	50.4				70.4	80
33	75.8	71.4	38.1	5.3	76.8	99.0	49.6			77	69.7	
32	75.2	71.1	37.4	4.2	76.2	98.6	48.8			76	68.9	
31	74.6	70.8	36.7	3.1	75.6	98.2	47.9			75	68.1	79
30	74.0	70.5	36.0	2.0	75.0	97.8	47.0				67.3	
29	73.4	70.1	35.3	1.0	74.4	97.5	46.1			74	66.7	78
28	72.9	69.8	34.6	0	73.8	97.2	45.3			73	66.0	77
27	72.3	69.5	33.9		73.2	96.8	44.4			72	65.3	
26	71.8	69.2	33.2		72.6	96.4	43.5				64.7	76
25	71.3	68.8	32.5		72.0	96.0	42.6			71	63.9	
24	70.7	68.5	31.8		71.4	95.7	41.8			70	63.2	75
23	70.1	68.2	31.2		70.7	95.3	40.9				62.6	
22	69.5	67.8	30.5		70.1	94.9	40.0			69	62.0	74
21	69.0	67.5	29.8		69.5	94.5	39.2			68	61.4	
20	68.5	67.2	29.0		68.9	94.1	38.3				60.6	73
19	67.9	66.8	28.3		68.3	93.8	37.5			67	60.2	
18	67.3	66.5	27.6		67.7	93.5	36.6			66	59.6	72
17	66.7	66.2	26.8		67.1	93.2	35.7			65	59.4	
16	66.2	65.9	26.1		66.5	92.8	34.8				59.0	71
15	65.6	65.5	25.4		65.9	92.4	34.0			64	58.6	
14	65.0	65.2	24.7		65.3	92.0	33.1			63	58.2	
13	64.4	64.9	24.0		64.7	91.6	32.3				58.0	70
12	63.8	64.6	23.3		64.1	91.3	31.4			62	57.6	
11	63.2	64.3	22.6		63.5	90.9	30.5			61	57.2	
10	62.6	64.0	21.9		62.8	90.5	29.6			60	56.8	
9	62.0	63.7	21.2		62.2	90.2	28.8				56.4	69
8	61.4	63.4	20.5		61.6	89.8	27.9			59	56.0	
7	60.9	63.0	19.8		61.0	89.5	27.0			58	55.8	
6	60.4	62.7	19.1		60.4	89.2	26.2				55.4	
5	59.9	62.3	18.4		59.8	88.8	25.3			57	55.0	68
4	59.3	62.0	17.7		59.2	88.4	24.4				54.8	
3	58.7	61.7	17.0		58.6	88.0	23.6			56	54.4	
2	58.1	61.3	16.3		58.0	87.7	22.7			55	54.0	
1	57.6	61.0	15.5		57.5	87.3	21.8				53.8	
0	57.1	60.7	14.8		57.0	87.0	21.0			54	53.4	67

* The comparative hardness values shown on this Conversion Chart are necessarily approximate. They have been obtained from reliable sources and reflect experience in repeated tests on a variety of materials. The primary assumption in the use of any conversion table is that the material is homogeneous to a depth at several times the indentation. If this is not so, a compromise hardness value is obtained which will vary with the degree of heterogeneity. Any hardness value obtained on such material will reflect this variation in the converted value and cannot be confirmed using a different indenter or test load. Assuming homogeneity, conversion tables still cannot be exact for all materials since they represent relationships existing between tests making indentations of different size and shape. The hardness value obtained in making a test is actually that the severely cold-worked material immediately surrounding the indentation. Consequently, a considerable variation in the observed hardness value will result from the difference in the amount of work-hardening introduced in making the indentation. Because of the difference in the cold-working properties of different materials, these variations cannot be standardized in a general conversion table. Special conversion tables for specific materials must be used for more exact hardness relationships.

MOST COMPLETE LINE OF INDENTATION HARDNESS TESTERS			
	Rockwell Scale	Vickers & Knoop	Brinell Scale
Portable Models	X	X	X
Bench Models	X	X	X
Floor Models	X	X	X

ADD CORRECTION TO DIAL READING

ROCKWELL
CYLINDRICAL TEST CORRECTIONS

Dial Reading	C, A & D Scales KENDENT Indenter					
	Diameter of Specimen—Inches					
	⅛"	¼"	½"	¾"	1"	1¼"
80	0.5	0.5	0.5	0.5	0.5	0
70	1.0	1.0	0.5	0.5	0.5	0.5
60	1.5	1.0	1.0	0.5	0.5	0.5
50	2.5	2.0	1.5	1.0	1.0	0.5
40	3.5	2.5	2.0	1.5	1.0	1.0
30	5.0	3.5	2.5	2.0	1.5	1.0
20	6.0	4.5	3.5	2.5	2.0	1.5

Dial Reading	B, F & G Scales 1/16" Ball Penetrator					
	Diameter of Specimen—Inches					
	⅛"	¼"	½"	¾"	1"	1¼"
100	3.0	2.0	1.5	1.0	1.0	1.0
90	4.0	3.0	2.0	1.5	1.5	1.0
80	5.0	3.5	2.5	2.0	1.5	1.5
70	6.0	4.0	3.0	2.5	2.0	1.5
60	7.0	5.0	3.5	3.0	2.5	2.0
50	8.0	5.5	4.0	3.5	3.0	2.0
40	9.0	6.0	4.5	4.0	3.0	2.5
30	10.0	6.5	5.0	4.5	3.5	2.5
20	10.5	7.5	5.5	4.5	4.0	3.0
10	11.5	8.0	6.0	5.0	4.0	3.0
0	12.5	8.5	6.5	5.5	4.5	3.5

Dial Reading	15N, 30N & 45N Scales KENDENT Indenter					
	Diameter of Specimen—Inches					
	⅛"	¼"	½"	¾"	1"	1¼"
90	0.5	0.5	0	0	0	0
80	1.0	0.5	0.5	0.5	0	0
70	2.0	1.0	1.0	0.5	0.5	0.5
60	3.0	1.5	1.0	1.0	0.5	0.5
50	3.5	2.0	1.5	1.0	1.0	0.5
40	4.5	2.5	1.5	1.5	1.0	1.0
30	5.5	3.0	2.0	1.5	1.0	1.0
20	6.0	3.0	2.0	1.5	1.5	1.5

Dial Reading	15T, 30T & 45T Scales 1/16" Ball Penetrator					
	Diameter of Specimen—Inches					
	⅛"	¼"	⅜"	½"	¾"	1"
100	0	0	0	0	0	0
90	2.0	1.0	1.0	0.5	0.5	0.5
80	4.0	2.0	1.5	1.5	1.0	0.5
70	6.5	3.5	2.5	2.0	1.5	1.0
60	8.5	4.5	3.0	2.5	1.5	1.5
50	10.5	5.5	4.0	3.0	2.0	1.5
40	12.5	6.5	4.5	3.5	2.5	2.0
30	15.0	7.5	5.0	4.0	2.5	2.0
20	17.0	8.5	6.0	4.5	3.0	2.0
10	19.0	9.5	6.5	5.0	3.5	2.5
0	21.0	10.5	7.0	5.5	3.5	2.5

The accuracy of the observed Dial Readings is seriously affected by the alignment of the supporting anvil and the penetrator. Such errors vary inversely with the diameter of the test specimen. The straightness of the specimen will also affect this accuracy.

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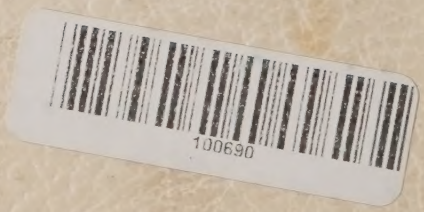
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